CALFED Bay-Delta Program Project Information Form

Watershed Program - Full Proposal Cover Sheet

Attach to the cover of full proposal. All applicants must fill out this Information Form for their proposal. Failure to answer these questions and include them with the application will result in the application being considered nonresponsive and not considered for funding.

1. Full Proposal Title: The Last Chance Assessment and Model Protocol
   Concept Proposal Title/Number: Assessment of the Impact of Land Management Practices on the Environment and Water Balances within the Feather River Basin – Proposal Number WSP01-0010

   Applicant: Plumas Corporation - Feather River Coordinated Resource Management Group and the University of California, Davis

   Applicant Name: Jim Wilcox and M. Levent Kavvas

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2. Type of Project: Indicate the primary topic for which you are applying (check only one)

__X___Assessment	_____Monitoring
_____Capacity Building	_____Outreach
_____Education	_____Planning
_____Implementation	_____Research

3. Type of Applicant:

_____Academic Institution/University	__X__Non-Profit
_____Federal Agency	_____Private party
_____Joint Venture	_____State Agency
_____ Local Government	_____Tribe or Tribal Government

4. Location (including County):
   What major watershed is the project primarily located in:
   _____Klamath River (Coast and Cascade Ranges)
   __X__Sacramento River (Coast, Cascade and Sierra Ranges){East Branch, North Fork Feather, Plumas County}
   _____San Joaquin River (Coast and Sierra Ranges)
   _____Bay-Delta (Coast and Sierra Ranges)
   _____Southern CA (Coast and Sierra Ranges)
   _____Tulare Basin (Coast, Sierra and Tehachapi Ranges)

5. Amount of funding requested: $ 586,000.00
Cost share/in-kind partners? __X__Yes _____No
Identify partners and amount contributed by each:

$20,000.00	SWRCB – Ambient Water Quality Program
$30,000.00	DWR – Reference Reaches

6. Have you received funding from CALFED before? __X_Yes ____No
If yes, identify project title and source of funds:
Last Chance Creek Watershed Restoration Project- Grant# 00-E01

By signing below, the applicant declares the following:

1. The truthfulness of all representations in their proposal
2. The individual signing this form is entitled to submit the application on behalf of the applicant (if the applicant is an entity or an organization)
3. The person submitting the application has read and understood the conflict of interest and confidentiality discussion in the Watershed Program Proposal Solicitation Package and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent provided in the Proposal Solicitation Package.

__**Plumas Corporation- Feather River Coordinated Resource Management**
Printed name of applicant

_____
John Sheehan, Executive Director- Plumas Corporation

PROJECT TITLE: The Last Chance Assessment and Model Protocol
PROPOSAL NUMBER: WSP01-0010

PROJECT DESCRIPTION:

Introduction:

The proposed project is the direct result of a collaborative effort between the 21- entity Feather River Coordinated Resource Management (CRM) group, the Plumas County Department of Public Works (PCPW), the Plumas National Forest (PNF) and the University of California Davis Hydrologic Research Laboratory (UCDHRL). This community-based, cooperative effort is an outgrowth of the 15 years of watershed restoration undertaken by the CRM. The knowledge gleaned from the successes and failures of these 50+ projects has underscored the importance of a full understanding of the functional attributes of a healthy watershed in reducing sediment, attenuating flood flows, increasing summer base flows and maximizing aquatic and riparian habitats.

The Feather River watershed is unique as a Sierran river in that approximately 10% of the watershed area is occupied by meadows and valleys. Historically these areas exerted a disproportionate influence on the function of the watershed. These low gradient meso-scale alluvial features served as water, sediment and nutrient sinks that buffered the watershed from extremes of flood, drought and landscape disturbance. Approximately 98% of the meadows and valleys in the Feather River have become severely entrenched (incised) through the cumulative effects of 150 years of mining, logging, grazing, road building and exacerbated wildfire. The watershed has not only lost the function of these buffering sinks but they have become disproportionately large contributors of sediment and accelerated discharges that have negative ramifications that extend from the watershed crest to the sea. The evolution of knowledge of the importance of these meadows and valleys has led the CRM to focus much of its restoration effort in re-establishing the function of these meadows on an ever-increasing spatial scale.

The purpose of the proposed project is to apply and calibrate a valuable tool, the UCDHRLM watershed model, to quantify the cumulative effects of this restoration on the hydrologic and sediment regimes of the Feather River watershed. This tool would inform local decision-makers as to the relative systemic benefits of proposed projects on-site and downstream. This same information would also assist project investors (CalFed, SWRCB and others) in evaluating and prioritizing future project funding allocations. The proposed project will use the California Department of Water Resources as the lead agency for CEQA requirements. It is believed that the proposed project is exempt from CEQA documentation requirements according to CEQA Categorical Exemption Class 6, Section 15306.

Project Description:

The proposed project intends to develop, implement and field calibrate an assessment protocol for restoration projects in the Last Chance Creek watershed, which is a 200 sq. km subwatershed of the Feather River located in Plumas County. The assessment protocol will examine the impact restoration projects have had on the Last Chance Creek watershed, and will be general enough so that it can be applied to other watersheds. As a part of this assessment protocol, a watershed model will be developed using the University of California Davis Hydrologic Research Laboratory watershed model (UCDHRLM). The model will be constructed in a nested fashion to cover subwatersheds on up through the whole of the Last Chance Creek watershed, and it will be capable of studying both the seasonal and long-term water balances of drought and wet periods including flood flows and sediment load. The model will provide an interactive complement to monitoring work completed in the field in order to assess the results of the restoration efforts and enable restoration projects to be compared under the same hydrologic conditions including extreme flood and drought periods. The model will be delivered to the CRM for their continued use beyond the proposed project time frame, and appropriate training will be

provided.

The anticipated outcomes of the proposed project are the assessments of environmental and water balance impacts of recent and currently funded restoration projects under flood and drought scenarios over the Last Chance Creek watershed by means of an interactive effort involving field monitoring and a nested watershed model. Besides being used as an interactive tool with field monitoring work in the assessment of the current restoration projects, the watershed model UCDHRLM can also be utilized to assist in the selection of future restoration projects. The watershed model would also have the potential to evaluate the watershed effects of other large-scale land management decisions in the Feather River basin. Another expected outcome of the proposed project is a general protocol for assessing watershed response that could be applied to other watersheds in the Bay-Delta system.

The proposed project will take place over a two-year period. In the first year, additional field equipment will be purchased and installed in order to increase the field monitoring capabilities in the Last Chance Creek watershed. A field assistant will also be hired to help with equipment installation and data collection. The watershed model for the Last Chance Creek watershed will also be developed in the first year. This will involve coordination between UC Davis and the CRM for data exchange and field site visits. Candidate restoration efforts to be assessed will also be chosen in the first year along with the flood and drought scenarios to be used in the assessments. In the second year, field data will continue to be collected which will be used in the calibration and verification of the model. Model results will be analyzed in order to determine possible adjustments to the field monitoring efforts as a part of the interactive assessment activities. Model simulations of the flood and drought scenarios will be run with prior and post restoration conditions in order to evaluate the impact of the restoration projects. During this time, a generalized assessment protocol will be developed for review by CALFED. As a means of refining the general protocol, and to further illustrate the use of the nested watershed model, candidate future restoration effort(s) will be selected for model simulation in order to provide an estimate of the impact versus expected cost of the restoration effort. Training of CRM staff in the use of the model will also take place in the second year. Progress reports and a final report will be written as required and a project presentation to CALFED will be made during the second year.

The methodology to be used in the proposed project includes an interactive field monitoring and numerical modeling approach. The field monitoring includes the operation of existing facilities, including a continuous streamflow/temperature monitoring station (Doyle Crossing, 1997-present), a RAWS satellite accessed station (Doyle Crossing, 2000-present), Big Flat Project long term monitoring (1994-present) and permanent reference reaches for geomorphology, substrate, benthics, fish population and water chemistry (1998-present).

While the existing resources provide an excellent foundation for model calibration, this proposal will include funding to provide an additional continuous streamflow/temperature station 12 miles upstream of Doyle Crossing, an additional RAWS station in the higher elevation, wetter, southwest portion of the watershed (headwaters of Jordan, Ferris, Artray, and Charles Creeks) and one monitoring technician in order to ensure more frequent operation of the above, particularly sediment sampling, in order to ensure adequate data are available. A map of the Last Chance Creek Watershed has been included in the proposal for reference to the above-mentioned sites.

The numerical modeling will be conducted with the UC Davis Hydrologic Research Laboratory Watershed Model. This watershed hydrology model, called “UCDHRLM”, was developed recently at UC Davis Hydrologic Research Laboratory (Kavvas et al. 1999; Chen and Kavvas,2000) after about a decade of research effort (Kavvas and Govindaraju, 1992; Tayfur and Kavvas, 1994; Chen et al. 1994a,b; Horne and Kavvas, 1997; Dogrul et al.1998). UCDHRLM is a physically based watershed hydrology

model which is based upon areally-averaged hydrologic conservation equations in order to account for the effect of spatial heterogeneity in land surface and subsurface conditions on the hydrologic flow processes. The model utilizes a detailed geographical information system (GIS) database for the vegetation, land use/land cover conditions, soils, topography and geology of the watershed being modeled for the objective estimation of the model parameters. The parameter estimation is accomplished by means of computer algorithms which relate the parameter values to land surface and land subsurface conditions, and not from a model fitting exercise. The model can describe both the Hortonian (infiltration excess) runoff mechanism as well as the variable-source-area runoff mechanism (Dunne, 1978). As such, it is applicable both to vegetated watersheds and arid/semiarid watersheds. It accounts explicitly for the interaction of subsurface stormflow, rill/gully flows and interrill-area overland sheet flow. The spatial grid resolution for UCDHRLM is mainly dictated by the resolution of the digital elevation map of the study area.

UCDHRLM may be run either as a stand-alone model with precipitation, radiation, wind speed, and air temperature information provided to it as inputs, or it can be run over the platform of a regional atmospheric/hydrologic model such as IRSHAM (Kavvas et al. 1998) which would provide UCDHRLM the precipitation and evapotranspiration information as input data at hourly increments. As such, UCDHRLM describes the interception, evapotranspiration, infiltration and unsaturated flow, subsurface stormflow, overland flow (with interacting rill/gully flow and sheet flow), groundwater flow (both regional and local scales), snowmelt, and channel flow in a stream channel network. UCDHRLM attempts to incorporate the dynamic feedbacks among various surface and subsurface hydrologic processes within a watershed. Since it has a physically-based, two-dimensional groundwater model, based upon Boussinesq equation, it is applicable both to sedimentary as well as to volcanic watersheds. Several state-of-the-art modeling equations are used to account for multiple variations affecting saturated, unsaturated subsurface stormflow and infiltration in relation to basin runoff. It models overland sheet flow, and rill/gully flow under kinematic wave approximation with appropriate forms for the channelized flow (for rills/gullies) and for sheet flow (Tayfur and Kavvas, 1994). The flow within the stream channel network of the studied watershed is modeled as kinematic wave over steep bed slopes, and as diffusion wave over mild bed slopes. Also, a two-dimensional channel flow routing component, based upon depth-averaged Navier-Stokes equations, was recently completed, and incorporated to UCDHRLM for its potential use in the modeling of instream erosion/sediment transport processes.

The output of UCDHRLM is the surface and subsurface flow discharges in time and space at the nodes of the numerical grid network over the studied watershed at a spatial grid resolution dictated by the digital elevation map resolution, and at time increments as short as 15 minutes. The soil water content for unsaturated soil water flow, the hydraulic heads for subsurface stormflow and for groundwater flow, the flow depths for rill/gully flow and stream flow, and infiltration and evapotranspiration rates are also provided in time and space over the numerical grid network. As such, UCDHRLM can be run both in an event-based mode as well as in a continuous-simulation mode.

The assessment of the restoration efforts in the Last Chance Creek watershed will be accomplished in the following manner. First, a model of the watershed will be constructed by implementing UCDHRLM to the watershed, and by utilizing data obtained from the CRM. The model will be calibrated and verified using the existing monitoring data. Candidate restoration projects will be selected for assessment based on discussions with the CRM. Land use/land cover characteristics associated with the selected restoration projects will be constructed in order to represent before and after land restoration scenarios. Critical wet and dry hydrologic periods will be identified for the purpose of evaluating the impact of the restoration projects on watershed response. Appropriate forcing data for the watershed model will be constructed utilizing the IRSHAM atmospheric/land surface process model (Kavvas et. al, 1998).

QUALIFICATIONS

The Feather River Coordinated Resource Management (CRM) group is a 15-yr old consortium of Federal, State and local agencies as well as private individual/organizations that sponsor and implement watershed restoration projects in the 3222 sq. mile upper Feather River watershed. These projects have been implemented on private and public lands, often involving multiple ownerships in a single project. The Last Chance Creek Watershed Restoration Project, a project funded by CALFED in 2000, will be encompassed by this proposal and is typical in that it is an integrated multi-ownership effort involving both private and federal lands. The proposed project continues the multiple interest, locally-based collaboration between the members of the CRM and local stakeholders along with the USDA, and Plumas National Forest that has been undertaken in previous CALFED funded projects. The CRM and its' staff have developed state and national renown as implementers of large scale geomorphic restoration projects. CRM staff operate out of Plumas Corporation, the primary implementation entity for the CRM. Plumas Corporation is a 501 (c) (3) private, non-profit corporation. These projects have been funded by a variety of sources, notably the SWRCB 319(h) and 205j programs, DWR Urban Stream Grant program, Proposition 204, Wildlife Conservation Board, CALFED Category III and USFS watershed funds.

The CRM has developed a comprehensive system of watershed trend monitoring in addition to regular project effectiveness monitoring. The purpose of this trend monitoring system is to track changes in watershed function over time (decades). This effort has been particularly focused in the Last Chance Creek watershed because of the severity of degradation and potential for implementation of restoration and management changes. The Last Chance Creek watershed is remote, predominantly under USFS ownership, and consequently should have a minimum of anthropogenically-derived "data noise" associated with more diverse ownership watersheds. To this end, with a variety of monitoring partnerships, the CRM has established a continuous streamflow/temperature monitoring station (Doyle Crossing, 1997-present), a RAWS satellite- accessed station (Doyle Crossing, 2000-present), Big Flat Project long term monitoring (1994-present) and permanent reference reaches for geomorphology, substrate, benthics, fish population and water chemistry (1998 – present). These monitoring components were funded by, respectively, the Regional Council of Rural Counties (RCRC)/SWRCB 319(h), California Department of Water Resources (DWR), Pacific Gas & Electric (PG&E) and DWR. The components are operated or coordinated by CRM staff.

All CRM project/program activities are conducted by CRM staff under the direct guidance and oversight of project specific Technical Advisory Committees (TAC). These TACs are composed of resource personnel, primarily from CRM agencies, landowners/managers and other interested stakeholders and public. The TAC process focuses a rich array of insight, expertise and disciplines, both local and regional, into the development of complex project solutions.

The UC Davis Hydrologic Research Laboratory (UCDHRL) has undertaken watershed modeling projects in California – the Scott Valley watershed, Calaveras watershed, Ward Creek watershed in the Lake Tahoe Basin and Camp Creek, North Fork and lower Cosumnes River subbasins in the Cosumnes River Basin – as well as internationally – Shiobara Dam watershed in Japan. These projects have been supported by funds from the USEPA/NSF Watersheds Program, the UC Water Resources Center, the National Institute for Global Environmental Change (NIGEC), the UC Davis EPA Center for Ecological Health Research, the US Army Corps of Engineers, the US Fish and Wildlife Service, and, recently, by CALFED through the UC Davis Center for Watershed Science. The international project was funded by the Government of Japan. The physically based watershed model is the result of more than a decade of research and development into hydrologic processes at the watershed scale. The project team will consist of a development engineer who has been associated with the model development from its inception as well as four post graduate research engineers who have contributed to the development and application of the model. The UCDHRL is also experienced in working on CALFED related projects having

contributed to the UC Davis Watershed Center's Cosumnes River project (CALFED GRANT # 99-NO6). The UCDHRL also has experience with field data collection having set up a field site in the Ward Creek watershed. These qualifications provide a sound basis for the successful completion of the proposed project.

The fiscal agent for the proposed project will be the University of California, Davis. Funds will be managed through the University to pay the UC Davis Hydrologic Research Laboratory team headed by Prof. M. Levent Kavvas with the CRM receiving its share of the funding as a subcontractor.

BUDGET COST SHEET, JUSTIFICATION, PERMITS

The proposed project has a budget of $632,000 of which funds are requested for $582,000. The rest of the budget will come from matching funds of which $30,000 will come from DWR – Reference Reaches and $20,000 will come from SWRCB – Ambient Water Quality Program. The requested funds will be used in the following manner. The FRCRM will use $160,000 of the $582,000 requested funds for the purpose of purchasing monitoring equipment, for the employment of a technician to assist current FRCRM staff in data collection from the field sites, and to cover costs associated with report preparation. The monitoring equipment funds are requested in order to obtain data from a portion of the Last Chance Creek watershed that exhibits wetter characteristics than the current monitoring sites.

The remainder of the $582,000 requested funds, $422,000 will be used to fund the development and use of the watershed model, UCDHRLM, for the proposed assessment study. The proposed project will provide one month of summer salary and associated benefits for Prof. M. L. Kavvas who will provide project coordination and administration. The funds will also employ a development engineer at 50% time who will work with four 50% time post graduate research engineers in the modeling effort. The personnel requirements are based on experience with similar modeling projects completed by the University of California Davis Hydrologic Research Laboratory. The salaries and benefits rates associated with Prof. M. L. Kavvas, the development engineer and post graduate research engineers are set by the University of California Davis and are detailed in the attached budget. Travel costs included in the project are to cover the costs associated with coordination and training trips between UC Davis and the FRCRM in Quincy, CA. The supplies budget for UC Davis is to cover costs associated with report writing and training documentation which will be given to the FRCRM staff.

The proposed assessment project does not require any permitting or CEQA documentation as noted earlier in the proposal. The proposed work has been broken into four separate budgetary tasks: administration, modeling, monitoring, and reporting. Please see the attached budget for detailed breakdown of the tasks and associated costs.

PROJECT BUDGET

Task Number	Labor Rate	Labor Total	Supplies	Travel	Materials	Sub-contracts	Match	CALFED	Total
1	See Note 1	$144,700	-0-	$1,000	-0-	-0-	-0-	$145,700	$145,700
2	See Note 2	$263,300	-0-	$3,000	-0-	-0-	-0-	$266,300	$266,300
3	-0-	-0-	-0-	-0-	-0-	$156,000	$50,000	$156,000	$206,000
4	See Note 2	-0-	$6,500	$3,500	-0-	$4,000	-0-	$14,000	$14,000
Total	-	**$408,000**	**$6,500**	**$7,500**	**-0-**	**$160,000**	**$50,000**	**$582,000**	**$632,000**

SUBCONTRACT BUDGET

Task Number	Labor Rate	Labor Total	Supplies	Travel	Materials	Sub-contracts	Match	CALFED	Total
3	$47/hr	$94,000	$5,100	$6,900	$50,000	-	$50,000	$156,000	$206,000
4	$47/hr	$ 4,000	-0-	-0-	-0-	-	-0-	$ 4,000	$ 4,000
Total	-	**$98,000**	**$5,100**	**$6,900**	**$50,000**	-	**$50,000**	**$160,000**	**$210,000**

Notes

1) The labor total for Task 1 is made up of 1 month of Prof. Kavvas' summer salary for each project year, the benefits costs for UCDHRL employees, and the total indirect costs that the University of California, Davis charges for the project. The indirect costs are obtained by multiplying the total direct costs of the project by 10%.
2) The labor total for Task 2 is made up of the salaries for a senior development engineer at 50% time and 4 post doctoral research engineers at 50% time. The labor for Task 4 is included in the labor costs for Task 2 (see Task 2d in Task Description).

TECHNICAL FEASIBILTY

Both the University of California, Davis Hydrologic Research Laboratory (modeling)and the Feather River Coordinated Resource Management group (project implementation and monitoring) have the demonstrated capacity and experience for undertaking the proposed project. The project is new in its scope of assessing restoration projects using an interactive combination of field measurements and modeling. The field monitoring currently under way in the Last Chance Creek watershed is being undertaken by the Feather River Coordinated Resource Management Group (CRM). The field monitoring includes a continuous streamflow/temperature monitoring station (Doyle Crossing, 1997-present), a RAWS satellite accessed station (Doyle Crossing, 2000-present), Big Flat Project long term monitoring (1994-present) and permanent reference reaches for geomorphology, substrate, benthics, fish population and water chemistry (1998-present). The components are operated or coordinated by CRM staff. The proposed work will expand the monitoring efforts in the Last Chance Creek Watershed via additional field monitoring and the addition of the modeling effort.

The incorporation of a watershed model into the monitoring efforts provides a means for obtaining a spatially distributed description of the restoration effects. Direct monitoring via field measurements provides information at the point where measurements are taken. The model expands that data as a means of monitoring the watershed as a whole. The model also provides the opportunity to study different restoration efforts under the same hydrologic conditions and can include studies of restoration efforts under extreme hydrologic conditions. Because the model is physically based and modular, it can be used to investigate changes to the watershed associated with restoration efforts that either have occurred or will occur. This makes the model a valuable tool for management of current and future restoration projects.

The watershed model to be used in the proposed study has been applied to the Ward Creek watershed in the Tahoe basin, in the Camp Creek tributary of the Cosumnes River watershed, and in the Shiobara Dam watershed in Japan. The Ward Creek project provided the first test of the newly developed watershed model to a 26 km^2 alpine watershed. Application of the model investigated the relative magnitude of processes contributing to flow in Ward Creek. Work continues in the investigation of sediment transport in Ward Creek in order to identify contributing areas which may be the source of nutrient loads and sediment into Lake Tahoe. The project in Japan was initiated by the Ministry of Construction Public Works Research Institute of Japan to investigate the use of the physically based watershed model for flash flood forecasting in the 123 km^2 forested Shiobara Dam watershed. The model has been applied using data from a rain-gage network and work is currently in progress on nesting the watershed model into a mesoscale atmospheric model in order to generate flash flood forecasts automatically from weather forecast data. The Camp Creek application of the watershed model UCDHRLM is part of a larger effort to build a watershed model of the entire Upper Cosumnes River Basin which will be able to provide flow and sediment information to biological and ecological studies going on in the Lower Cosumnes River Basin. The Cosumnes River watershed model is still under development for the total watershed area.

While the modeling and monitoring efforts individually are not new techniques, the interactive approach and protocol for assessing restoration efforts will provide new knowledge to CALFED that can be applied to other watersheds impacting the Bay/Delta system. The watershed model will be calibrated and verified using data already collected as part of CRM's past monitoring efforts. Once the model is calibrated and verified, candidate hydrologic periods will be selected for the assessment of the restoration activities. These hydrologic periods will include both extreme wet and dry periods. The restoration projects will then be assessed by examining watershed response during selected hydrologic periods under conditions prior to the restoration project and conditions after the restoration project. The difference between the hydrologic responses will provide information on how the restoration project is impacting

the watershed which will provide information towards how the restoration projects impact the Bay/Delta system. Future restoration efforts could be simulated by the watershed model in order to assist in the planning and evaluation of such efforts.

During the course of the proposed project, the sediment transport component of the watershed model will be implemented. It will include new technologies for watershed/erosion sediment transport modeling. With the watershed modeling approach, rill, gully, and sheet flow upland erosion can be incorporated into the simulations in addition to the in-stream transport. The erosion sediment transport model component was recently incorporated into UCDHRLM, and is currently being validated successfully by application to historical sediment data from the Ward Creek watershed. The UCDHRLM, including its erosion/sediment transport module, will be available at the starting date of the project.

It is not anticipated that future funding will be needed for the proposed project. The watershed model of Last Chance Creek for assessing restoration projects will be turned over to the CRM for their continued use. Appropriate training in the use of the model will be supplied during the course of the proposed project. The model will be available for proposed simulations in order to investigate future changes to the Last Chance Creek watershed. It is not anticipated that CALFED would need to provide funding for such future simulations.

MONITORING

Project Objectives: The proposed project seeks to apply and evaluate to efficacy of a physically-based watershed model, the University of California, Davis Hydrologic Research Laboratory Model, UCDHRLM, on an actual watershed restoration project, the Last Chance Creek Watershed Restoration Project. The Feather River Coordinated Resource Management (CRM) group has been implementing and monitoring stream channel meadow restoration projects since 1995. Project specific monitoring has indicated local hydrologic changes (decreased flood peaks, extended and increased baseflows, decreased sediment supply and lower water temperatures) from these efforts. The purpose of this model and monitoring effort is to identify and quantify these changes at the larger watershed scale. To this end the CRM has installed and operates a system of remote stations and reference reaches to detect long-term change in watershed function using a variety of physical, chemical and biological parameters.

Current Monitoring Activities: The field monitoring currently under way in the Last Chance Creek watershed is being undertaken by the Feather River Coordinated Resource Management Group (CRM). The field monitoring includes a continuous streamflow/temperature monitoring station (Doyle Crossing, 1997-present), a RAWS satellite accessed station (Doyle Crossing, 2000-present), Big Flat Project long term monitoring (1994-present) and permanent reference reaches for geomorphology, substrate, benthics, fish population and water chemistry (1998-present). The components are operated or coordinated by CRM staff. The proposed work will expand the monitoring efforts in the Last Chance Creek watershed via additional field monitoring and the addition of the modeling effort.

This monitoring, funded by the Ca. Dept. of Water Resources and the State Water Resources Control Board, will be augmented by the addition of another continuous streamflow/temperature station (Dooley) 12 miles upstream of Doyle Crossing and a RAWS station in the higher elevation, wetter, southwest portion of the watershed. The additional stations and the need for more comprehensive data collection will require the services of a part-time monitoring technician to assist CRM staff. The Last Chance Creek watershed has no vehicular access in the winter months. All access is via snowmobile, with periods each winter when even snowmobiles are shut-out (deep powder or slush).

Project Monitoring Activities: This additional data collection will entail frequent, often daily, streamflow, turbidity and suspended sediment sampling during winter flood events and spring runoff. These measurements will be taken with a portable bridge crane at Doyle Crossing and via wading at the Dooley and Big Flat stations. Direct streamflow measurement requirements will diminish as accurate stage/discharge rating tables are developed for the stations. Existing piezometers at Big Flat will continue to be measured at least monthly, if not more frequently, as conditions warrant.

The CRM is currently participating in a water chemistry monitoring effort with Plumas Geo-Hydrology for the purpose of tracking seasonal and source changes via pH, chloride, sulfate and alkalinity and stable isotopes of deuterium and oxygen-18. Preliminary studies indicate that isotopes and minerals increase in late season as more streamflow originates from ground-stored water. Changes in these constituents would be further indication of enhanced seasonal retention of runoff in the watershed.

This expanded monitoring effort is designed to be maintainable after the proposed project is completed. This recognizes that no two-year period will provide opportunity to measure the range of conditions necessary to adequately assess changes in watershed function. The continued monitoring will be incorporated into the UCDHRLM model by the CRM for further analysis and decision-making efforts in the decades to follow.

SCIENTIFIC BASIS

The CRM has developed a comprehensive system of watershed trend monitoring in addition to regular project effectiveness monitoring. The purpose of this trend monitoring system is to track changes in watershed function over time (decades). This effort has been particularly focused in the Last Chance Creek watershed because of the severity of degradation and potential for implementation of restoration and management changes. To this end, the CRM has established a continuous streamflow/temperature monitoring station, a RAWS satellite accessed station, Big Flat Project long term monitoring and permanent reference reaches for geomorphology, substrate, benthics, fish population and water chemistry. The components are operated or coordinated by CRM staff. As a means of expanding upon this monitoring effort, the proposed project aims to create an assessment protocol using an interactive process combining the field monitoring with simulations by a physically based watershed model.

The watershed model to be used in the proposed study has been used in the Ward Creek watershed of the Lake Tahoe Basin, the Shiobara Dam watershed of Japan, and the Camp Creek tributary to the Cosumnes River. These studies involved the examination of watershed processes contributing to a flood hydrograph such that the model could be used for prediction of flows with respect to changes in watershed conditions. The Shiobara Dam watershed study is examining the possibility of using the physically based watershed model for flash-flood forecasting in the 123 km^2 watershed. The success of these studies provides confidence that the physically based watershed model can be incorporated as part of an interactive assessment protocol combining field monitoring and modeling to evaluate restoration efforts in a watershed.

The field monitoring effort tracks the response of the watershed to existing hydrologic conditions. CRM staff have ample experience in field monitoring efforts and have a field-monitoring program already in place for the Last Chance Creek watershed. The expansion of this monitoring effort to incorporate numerical modeling allows information on the restoration projects to be gained over the whole watershed instead of at only the observation locations. Such information would otherwise not be available. The physically based watershed model provides a means to assess different restoration projects under the same hydrologic conditions. It also provides a means to assess the restoration projects under extreme conditions. With such information, the impact of different restoration projects can be compared more directly. The protocol developed as a part of the proposed project can also be used as a means to evaluate potential restoration projects in order to assist in the prioritizing of these efforts. The proposed project aims to contribute to CALFED's goals of monitoring changes in watershed conditions in terms of their impact on the Bay-Delta system with the development of the generalized protocol which can be used on any of the watersheds feeding into the Bay-Delta system.

The proposed project assumes that the assessment of restoration efforts can be quantified through a combination of field monitoring and modeling with a physically based watershed model. The goal of the project is to develop a general assessment protocol while providing assessments to past and current restoration projects in the Last Chance Creek watershed. CRM members who possess extensive field experience are undertaking the field monitoring effort and will interact with the modeling group so that a useable and effective assessment protocol can be developed. The UC Davis Hydrologic Research Laboratory is a well-known group with a physically-based watershed model which is capable of simulating the effects of the restoration projects under specified hydrologic flood and drought conditions. They have more than a decade of experience in watershed modeling and are familiar with the Feather River basin.

CALFED OBJECTIVES

The proposed project meets both CALFED Watershed Program goals of providing a tool and protocol that will assist in the achievement of the mission and objectives of CALFED, and offers a means for collaboration and integration of existing and future watershed programs throughout the CALFED Solution Area. Specifically, the proposed project provides a tool that will effectively build community capacity to assess and effectively manage the Last Chance Creek watershed as well as other major subwatersheds that comprise the Feather River basin, the major water supply basin for the State Water Project, which is an integral inflow component to the Bay-Delta system. The associated assessment protocol developed in the proposed project would then be available for use in other watersheds in the CALFED program.

The proposed project provides a means to evaluate the hydrological and environmental impacts of projects within the watershed, including other CALFED projects, and provides a means to refine future projects in order to maximize their effectiveness in the continued restoration of the watershed. Specifically, the model can provide a numerical assessment of a project's potential influence on flood attenuation and baseflow augmentation. These are not yield values, but season of basin delivery (timing) values. This will contribute to the long-term sustainability of local watershed programs for the Feather River watershed. The proposed project incorporates and enhances existing project and watershed trend monitoring efforts undertaken by the CRM. The modeling and monitoring process will be further enhanced by the strong inclusion of local professional knowledge gleaned from the ongoing 15-year CRM implementation program.

Both the FRCRM and members of the UCDHRL agree to the standard terms of agreement as outlined in the proposal solicitation package. The California Department of Water Resources (DWR) will act as the lead agency for CEQA environmental compliance as specified by CALFED. The proposed project is believed to be exempt from having to produce CEQA environmental compliance documentation under a categorical exemption Class 6, Section 15306.

LITERATURE

References

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CALFED WATERSHED PROGRAM BUDGET AND PROJECT SUMMARY II

Project Title: **The Last Chance Assessment and Model Protocol**

		Project Time Frame	Match funds	CALFED funds	Total
	Total Budget	**24 Months**	**$ 50,000.00**	**$ 586,000.00**	**$ 636,000.00**

	Task Description	Completion date	Match funds	CALFED funds	Total
Task 1:	Administration:	Ongoing	$ -	$ 145,300.00	$ 145,300.00
Task 1a:	*Prof. M. L.Kavvas will act as Project Administrator for UC Davis and will coordinate work with the FRCRM via Jim Wilcox. Prof. Kavvas will be paid one month of his summer salary each year of the project. Quarterly progress reports will be sent to CALFED along with a final report when the project is completed. The reports are detailed in Task 4.*	Ongoing	$ -	$ 24,950.00	$ 24,950.00
Task 1b:	*Benefits - For UC Davis Employees, the benefits are computed as follows: Prof. M. L. Kavvas 9.2% of salary, Development Engineer and Post Graduate Research Engineers 24.5% of salary for year 1 and 25% for year 2. The benefits rates are set by the University of California Davis*	N/A	$ -	$ 67,475.00	$ 67,475.00
Task 1c:	*Overhead - 10% of Direct Costs. Rate set by University of California, Davis*	N/A	$ -	$ 52,875.00	$ 52,875.00
	Task Product(s): None				
Task 2:	Modeling	Month 24	$ -	$ 266,300.00	$ 266,300.00
Task 2a:	Model Development and Calibration	Month 12	$ -	$ 125,800.00	$ 125,800.00
Task 2b:	Assessment Simulations	Month 20	$ -	$ 68,500.00	$ 68,500.00
Task 2c:	Protocol Development	Month 24	$ -	$ 67,000.00	$ 67,000.00

Task 2d:	FRCRM Staff Training	Month 24	$ -	$ 5,000.00	$ 5,000.00
	Task Product(s): Last Chance Creek Watershed Model, Assessments, Assessment Protocol Success Criteria: Acceptance of model, assessment results and protocol by FRCRM, CALFED, and Contract Manager				
Task 3:	Monitoring	Month 24	$50,000.00	$ 160,000.00	$ 206,000.00
Task 3a:	Equipment Purchasing and Installation	Month 12		$ 110,000.00	$ 110,000.00
Task 3b:	Data Collection	Ongoing	$50,000.00	$ 46,000.00	$ 96,000.00
	Task Product(s): Field Monitoring Data Success Criteria: Generation of field data				
Task 4:	Reporting and Presentations	Ongoing	$ -	$ 5,000.00	$ 5,000.00
Task 4a:	Quarterly progress reports: Progress reports on project implementation, including financial status, milestones reached, products completed, and general assessment of overall progress, including problems encountered or anticipated.	Ongoing	$ -	$ 2,500.00	$ 2,500.00
Task4b:	Draft final report: Draft report summarizing the project implementation, achievements, product deliveries, financial status. To be sent to the Contract Manager for review and comment.	Month 22	$ -	$ 1,000.00	$ 1,000.00
Task 4c:	Final report: Revised report incorporating comments from the Contract Manager and others.	Month 24	$ -	$ 1,000.00	$ 1,000.00
Task 4d:	Presentations: Delivering at least one final summary presentation to CALFED.	Month 24	$ -	$ 500.00	$ 500.00
	Task Product(s): Reports and Presentations Success Criteria: Acceptance of Reports by Contract Manager and CALFED				